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THE AGE OF THE EARTH

COMMENTS ON SOME GEOLOGIC METHODS USED IN ITS DETERMINATION

DUDLEY JOSEPH WHITNEY

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No. 14 June 1966 30¢

"Only grandma can make me mind," said a willful child.
"How does grandma do it?"
"She tells me to do what she tells me, *or not* do it."

Thus the evolutionists have made their rules so that they will work three speeds ahead and *reverse*. If God Almighty was to make outright and forthwith, a new creature of flesh with bone or no bone, red blood, white blood, hot blood, cold blood, rig it out with electric lights, artillery, umbrella and any instrument in the orchestra; they would fence it in with rules and shoo it into their menagerie. Here are some of the rules abbreviated:

I. Be like your ancestors or be different.

II. The fittest shall survive and the unfit may live.

III. Grow big or stay little; either will help you to survive or not.

IV. That your family may survive, lay a million eggs or give birth to one.

V. Unused organs shall disappear or persist.

VI. Rudimentary organs are what you have had or what you will have.

VII. Win a mate by combat or not; it will help the family survive, or not.

VIII. Polygamy will help survival, unless you prefer to mate in pairs.

IX. Fight your neighbors or unite with them; one way or the other will help.

X. Wear gaudy colors or avoid display, so shall your family survive.

XI. Develop legs, wings, tail, horns shells or not; they will help, or not.

XII. Remember, it's a THEORY. Don't let any man see you MAKING wings out of warts or Adams out of apes.

B. H. Shadduck

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THE AGE OF THE EARTH

Comments on Some Geologic Methods Used in its Determination

Dudley Joseph Whitney

For the past century it has been one of the chief objectives of study on the part of geologists to determine the age of the earth. This interest dates from the time of Cuvier, whose philosophy on successive creations and catastrophies obviously demanded more time than Biblical chronology would allow. Cuvier's conjecture as to the age of the earth was some fifty or sixty thousand years, an estimate which must have been arrived at largely by guesswork as far as any available supporting evidence was concerned. On the basis of this same theory of repeated creations and cataclysms, Agassiz increased the length of this period to one hundred thousand years.

With the development of the theory of Organic Evolution with its many problems of transition from simple to more complex forms of animal life, it came to be realized that the earth must be extremely ancient to permit of the evolution of man from some one-celled antecedent. While no definite age is now insisted on, the present estimates vary between one thousand million and ten thousand million years, with the consensus of opinion favoring about two thousand million years. This estimate has been reached by a determination of the apparent age of various rocks through radioactivity, which method will be discussed in due time.

It is the purpose of this study to show that, by certain data worked out by geologists, no such an extreme age of the earth can be established and to show to the contrary the earth cannot be so very old. A study of available data indicates that no adequate time interval sufficient to make organic evolution possible is allowed.

Ocean Elements in Their Bearing On the Age of the Earth

Up to about twenty years ago, the most acceptable way of estimating the probable age of the earth was by a comparison of the amount of the element sodium in the ocean with the amount carried into it each year by the rivers. As rain water falls upon the land, it gathers up the various soluble materials derived from the weathering of the rocks and carries into the rivers, and ultimately into the ocean, great amounts of soluble material which either remains in solution or is precipitated upon the ocean floor. This process is believed to have continued since geologic history began. Assuming that the rate of increase of chemical substances has been fairly uniform throughout geologic time, the time needed to accumulate the sodium in the ocean in this way was once believed to indicate the age of the ocean and hence the approximate age of the earth. By assuming that the ocean was composed of fresh water at the start and that it has increased in salinity at the present rate, geologists estimated that the earth was between 60 and 100,000,000 years old.[1]

The bulletin by Clarke on "The Data of Geo-chemistry" is probably the most comprehensive work on geochemistry available, and the data in it are generally considered quite reliable. In the accompanying table (Table I) the annual increase of the various elements in the ocean is shown as taken

[1] Clarke, F. W., "Data of Geo-chemistry," *U. S. G. S. Bulletin No.* 770, 1924, chapter 4, "The Ocean."

from the fifth edition of this work. The figures in the last column are the results of calculation by the writer and not by Clarke. These figures are given in round numbers only.

Sodium. Considering the figures for sodium alone, it would seem that the ocean could not be more than 90,000,000 years old, but by making certain allowances, such as the return of small quantities of salt from the ocean to the land, Clarke estimated the ocean to be about 100,000,000 years old. In this estimate, no allowance was made for any initial salinity of the ocean, although it is likely that some allowance should be made.

period, the surfaces of the continental masses (hundreds of millions of years ago) would either have been depleted of their soluble contents, or the ocean would be far more saline than it now is.

By analysis it should be clear that, taking sodium as a basis of computation, the ocean is not more than one-twentieth of its presumed age, now generally believed to be 2,000,000,000 years, and this figure makes no allowance for any original salinity.

Potassium and Magnesium. The amounts of magnesium and potassium now in the ocean suggest an outside limit of from 9 to 19 millions of years as the age of the earth. These figures also make no allowance for any original salinity of the ocean. Geologists argue, however, that sufficient amounts of potassium and magnesium are precipitated out of solution to make these elements useless as indicators of the age of the earth. However, the salts of both these elements in the ocean are extremely soluble, and Clarke's own data on the composition of marine sediments show that such sediments contain too little of these elements in precipitated form (potassium and magnesium) to make up the discrepancy. Therefore, this argument is not valid, and these two elements further testify that the ocean is by no means as old as it has been believed to be.

TABLE I
Age-Index Elements in the Ocean

Element	Metric Tons In Ocean x 1,000,000,000,000	Annual Increase in Tons x 1,000	Years Necessary to Attain this Amount
Sodium (Na)	14,130.0	158,357	90,000,000
Potassium (K)	510.8	57,982	8,800,000
Magnesium (Mg)	1,721.0	95,264	18,400,000
Sulphate (SO_4)	3,553.0	332,030	10,600,000
Chlorine (Cl)	25,538.0	155,350	164,400,000
Calcium (Ca)	552.8	557,670	

To account for the difference between 100,000,000 years and the 2,000,000,000 years now commonly accepted for the age of the earth, some geologists have tried to show that the rivers could run to the sea for many more years than the increase of sodium will allow,[2] but without success.

One insurmountable difficulty which has been largely ignored, is that the land (according to the popular theory) had no covering of vegetation to evaporate the moisture and to protect the rocks from leaching, until well into the Devonian period, or for approximately four-fifths of presumed geologic time. Weathering of the rocks and leaching of soluble material from the land during this interval would obviously be extremely rapid. With this process going on for so long a

[2] Holmes, Arthur, "The Age of the Earth," 1927, chapter 3.

Chlorine. In some respects chlorine is the most important element in the ocean when it comes to estimating the possible age and history of the ocean. From the figures given by Clarke it is evident that the ocean contains seven times as much chlorine as sulphate, which is the equivalent of 21 times as much of the element sulphur. Yet more than twice as much sulphate as chlorine is being added to the ocean by river flow and in other ways. Unless, therefore, the ocean were very rich in chlorine from the beginning and also contained very little sulphate, the amount of sulphate in the ocean should far surpass the amount of chlorine. And yet the contrary is the case.

There seems to be only three ways to account for the chlorine in the ocean: (1) that it was there from the beginning, (2) that it was added by leaching from the land, or (3) that it had its origin from within the earth, being added to the ocean water through volcanic action. But the rocks contain very little chlorine, so no great amount could have been obtained from that source. Clarke gives the chlorine content of igneous rocks as 0.048 per cent while the sulphur content is 0.052 per cent. There is 55 times as much sodium in these rocks as there is chlorine, so very little chlorine could have been added to the ocean by the disintegration of rocks and their consequent leaching. Neither could volcanic activity have added much chlorine to the ocean. In the analyses of volcanic gases cited by Clarke, time after time chlorine is not even mentioned, and only rarely is it found to occur in notable amounts. Frequently it is given only as a trace. Consequently, most of it must have been in the ocean from the beginning, and there it would be combined, as it is now, with sodium and magnesium, or with other bases.

This is a feature of the utmost importance in studying the possible age of the earth, for no one can properly compute how old the earth may be through the annual increase of sodium, potassium, magnesium and sulphate, without making allowance for the initial content of these materials. Since they were possibly abundant in the ocean in the beginning, a very limited amount of time might suffice to make the ocean as saline as it is now. The rapidity with which the elements named are increasing by the leaching of the land not only suggests that the earlier method of figuring the age of the earth by the increase in sodium was worthless, but also that the earth cannot be extremely old.

Sulphur and the Sulphates. From the figures in Table 1 it would seem that sulphur is of greater significance in estimating the possible age of the earth than sodium, for while 90 to 100,000,000 years of river flow would provide all the sodium of the ocean at its present rate of increase, a little more than 10,000,000 years of river flow would account for all the sulphates in the ocean.

But in addition to this source of sulphates, must be considered the important fact that much sulphur is also added to the ocean from the air. Oxides of sulphur exist in considerable quantities in the air, notably so in the vicinity of volcanoes, from which sulphur is emitted in great amounts. When rain falls, these oxides are carried to the ground or fall into the ocean and in combination with calcium or some other bases form sulphates.

As Clarke points out, some 17.26 pounds of sulphuric oxide were added per acre per year to the land by rainfall over a period of five years at Rothamsted, England. This is the equivalent of nearly 21 pounds of sulphates (SO_4). Considering the fact that the seas cover more than twice

the area of the land, it will be seen that probably more sulphur is added to the ocean from the air than by riverflow. By this method (and still making no allowance for any original sulphates), the maximum possible age of the earth would be five or six, instead of eleven million years.

But there is still another factor to be given consideration in the matter of the sulphur content of ocean water, and that is, volcanic action as the source of this element. The great amount of sulphur emitted from volcanoes is clearly shown by the fact that one volcano in Japan in one period of eight months in 1937 sent forth an estimated 200,000 tons of pure liquid sulphur in addition to enormous unmeasured amounts of sulphur in volcanic gases. From another Japanese volcano in 1936 there was an "outflow of an enormous volume of pure fluidial sulphur from an old explosive crater."[3] Since volcanic activity seems to have been far greater not so long ago than it is at present, and is said to have continued for millions of years, the ocean should contain far more sulphur than it actually does. No long period of time such as has been predicated could possibly have elapsed without overwhelming the earth and the seas with the compounds of sulphur.

From a study of the salts of the ocean it therefore seems clear that the ocean cannot possibly be anywhere near as old as it has been estimated to be on the basis of the geologic timescale.

Depletion of the Land by Leaching

The figures given by Clarke contribute in still another way to this problem of the age of the earth. His data regarding the depletion of the land of its soluble salts by leaching are rather significant. It should be noted that practically as much chlorine is carried into the ocean as sodium, the two evidently being carried largely in combination as sodium chloride or common salt. Sodium has the atomic weight of 23 and chlorine of 35.5. This indicates that almost exactly two-thirds of the sodium goes off as sodium chloride, not by disintegration of rocks. This seems evident since Clarke gives the chlorine content of the upper rocks as only 0.05 per cent, and that of sodium as 2.75 per cent, making sodium 55 times as abundant on land as chlorine. The calcium content of the rocks is given as 3.64 per cent.

Clarke points out that it would take a layer of igneous rock a third of a mile (1,760 feet) thick over the entire globe to provide the sodium that is now present in the ocean. The disintegration of half a mile of rock would probably be required to supply this amount since some of the sodium would remain with the silica and as other insoluble residues. But if all of the land above sea level were spread evenly over the face of the earth, it would make a layer only 660 feet thick, only three-eighths of the required one-third of a mile. Thus if every bit of rock above sea level were completely leached of sodium, it would provide only about one-third of the sodium now present in the ocean. Where, then, did the rest of the sodium come from?

The conclusion demanded by these facts is that most of the sodium of the ocean was there from the beginning, and probably the same can be said for most of the other elements there in solution. By the figures cited above, all the sodium above sea level would be removed from the land at the present rate in about 32 million years, and all the chlorine in about a million years. But since neither of these ele-

[3] Watanabe, T., and Suzuki, J., *Pan-American Geologist*, June, 1939, p. 335.

ments has been completely removed from the land by a considerable amount, it is evident that, whatever the real age of the earth, actually no great expanse of time has elapsed.

Calcium as an Indicator of the Age of the Earth

While the figures pertaining to the amount of calcium in the ocean are more suggestive of the way the land is being depleted of this element than they are to the age of the ocean, they probably do have some significance in this direction. Although igneous rock contains only about one-third more calcium than sodium, about three and a half times as much calcium is being carried into the ocean as sodium. At this rate the land would lose all its calcium in a little more than 12 million years. One must therefore wonder how the continents could have continued to supply calcium to the ocean for alleged hundreds of millions of years. As a matter of fact, the rocks above sea level in spite of weathering and leaching still contain an abundance of soluble materials. It is therefore inconceivable that the earth has gone through any such long history as the modern concept of geology demands.

The Testimony of the Sedimentary Rocks

The increase in the soluble contents of the ocean is not the only means which has been used in determining the possible age of the earth. Another means that is often considered in any study of this problem is the thickness of the sediments in relation to the rate that sedimentary rock is laid down. By dividing geologic history into a series of eras, periods and epochs, and estimating the greatest thickness of rock for each period, geologists have calculated that the age of the earth is about 60 million years, by adding all these thicknesses together and figuring how long it would take to form them at the rate sediments are now being laid down in river deltas.[4] Subsequent studies on this point have added considerably to this estimate.

There are two fundamental errors in this method of calculation. The first is the obvious error of adding the thickness of sedimentary rock in one locality to that in another and so on for a series of such thicknesses, when there is absolutely no evidence to show that such a series of layers ever existed in any one locality. Moreover, there is no evidence to contradict the conclusion that in any one locality, all such layers were superimposed in a relatively short time, and that over great stretches of the earth's surface. The second defect is that, instead of presuming that these sediments were laid down very slowly as in a river delta, the predominant indications are that they were laid down very quickly by water, one layer succeeding another. This last principle seems to be recognized, at least in some circles. Thus Holmes writes:

> "Another difficulty arises from the fact that the thickest formations can never represent a continuous record of all time involved. Individual beds may have been deposited very rapidly, and indeed they must have been to insure the burial and preservation of large fossils."[5]

This last sentence contains a principle of fundamental importance in this problem of rate of deposit of the various strata. If a great mammoth or dinosaur had to be buried with cataclysmic rapidity to be preserved as a fossil, and beds containing hundreds or thousands of such fossils must needs have been buried at the same time, the necessary extent and rapidity

[4] Schuchert, Charles, "The Age of the Earth on the Basis of Sediments and Life," Bulletin 80, National Research Council, 1931, "The Age of the Earth," pp. 10-65.

[5] Holmes, Arthur, *loc. cit.*, p. 83.

of such burials can be roughly appreciated.

These self-evident facts should make it clear that any effort to estimate the age of the earth on the basis of rate of deposit of the sediments, as is now being used, can only lead to extremely erroneous conclusions, widely divergent from the true facts.

Atmospheric Helium as an Evidence of the Relative Youth of the Earth

There are still other lines of evidence which show that the earth is not old, although to be sure, they do not tell us exactly how old it might be. Atmospheric helium is known to be increasing quite rapidly (at an unknown rate), although there are still comparatively small amounts of it present in the air. Unless some of it escapes into space, which is very improbable, this element could not have been added to the atmosphere over any great length of time.

The increase of this element in the air may come about in two ways: (1) by its emission from certain springs, and (2) from the radioactive elements uranium and thorium which are continually changing into helium and lead. These two elements are widely distributed in the granite rocks, and as the rocks disintegrate, the helium passes out into the air. On this point Jeffreys writes:

"If the average age of igneous rocks when denuded was 160 million years, all the helium in the atmosphere would be explained if the average thickness of igenous rocks denuded from the earth's surface was 40 meters. This is an impossible small amount. . . . No satisfactory explanation of why the atmosphere contains so little helium has been offered."[6]

In other words, the atmosphere contains an impossibly small amount of helium for the age of the earth as it is now asserted to be. Jeffreys does not assert that helium escapes into space as the solution of the difficulty. Russell does so, not however, until he has agreed that according to the kinetic theory of gases, it should not be so escaping.[7] The opinion of Walter S. Adams seems to be conclusive on this point and he writes:

"The mass of the earth is sufficient to maintain a hydrogen atmosphere almost indefinitely."[8]

Since helium is several times as heavy as hydrogen the theory of its escape into space seems invalid. On this point of the formation of helium, it may therefore be stated that, while helium is being formed at a fairly rapid rate, there is still very little in the atmosphere. And this is evidently not because it is escaping into space. This conclusion indicates that the process has not been going on for more than a small fraction of the time, which evolutionary geology demands.

Evidence from the Comets and Meteors

Comets provide evidence from an astronomical point of view that the earth is not particularly ancient. This is suggested by the fact that comets waste away and are broken up into streams of meteors without any new comets coming into existence as far as is now known.

The most striking feature of comets which pass close to the sun is their tail, which is composed of material driven from the head by radiant pressure from the sun. This material is permanently lost to the comet as far as is known. Thus each time a comet passes near the sun it loses some of the material which composes it, and in time it is completely destroyed or its orbit so altered that it no longer

[6] Jeffreys, Harold, "The Earth", 1924, p. 254.

[7] Russell, Henry Norris, "The Solar System and Its Origin," 1935, pp. 75, 76.

[8] Adams, Walter S., *Scientific Monthly*, July, 1934, p. 13.

approaches the sun and may be lost to observation.

Russell discusses this matter and points out that the force of gravity of Jupiter and other large planets tends to act upon comets which pass near them so that they will be projected out of the solar system, which will make them no longer visible from the earth. This effect is more probable than some change in their orbit, which makes them pass near the sun. Several comets have been known to have been destroyed or changed into streams of meteors in the last century. Halley's comet, the most famous of all, has lost much in size in its last few passages near the sun. In fact, the wasting of comets is so rapid that it strongly suggests that the life of the solar system should be estimated in thousands rather than millions of years.

Still another detail pertaining to meteors which gives one some concept as to the age of the earth is concerned with meteor dust. Meteorites contain much iron and it is likely that meteors do likewise, although they are burned to dust by friction as they pass through our atmosphere. This dust settles upon the earth. The iron of meteorites contains considerable quantities of nickel. Consequently, if there is much meteor dust on the earth, there should be a measurable quantity of nickel in it. This is not the case, for nickel is found in too small quantities to be significant.

Clarke gives the average meteoric iron as being composed of 90.85 per cent iron, 8.52 per cent nickel, and 0.59 per cent cobalt. Copper and chromium are the only other metals abundant enough to be mentioned. Even stony meteorites are said to contain an average of 1.32 per cent nickel and cobalt. It goes without saying that if meteors and meteorites have been falling on the earth for millions of years, an appreciable amount of nickel should be found on the earth's surface, or if dissolved and carried by the rivers to the oceans and there precipitated, it should be found in some quantity on the ocean's floor. It is found in neither place in more than a trace. Clarke does not even list nickel in his record of analyses of marine sediments, and nickel and cobalt together in two analyses of marine clays amount to only .039 and .064 per cent respectively, which amounts could well be derived simply from terrestrial matter.

There is some uncertainty regarding the amount of meteoric matter which falls from the earth, but Nininger estimates that the daily accretion is of the magnitude of 50,000 tons.[9] This would make a layer of about 100 feet thick in the course of two thousand million years. Whether Nininger's estimate is correct or not, after this enormous lapse of time nickel should be found in good quantities over most of the face of the earth and upon the ocean floor. Instead, it is found in such small quantities that the earth by this standard must be extremely young.

Meteorites are unknown in *underground*, supposedly "ancient," sediments, which should not be the case if they had accumulated through uncounted millions of years. They reach the earth fairly frequently today and very likely have done so in the past. But they are all on the surface. The absence of such "fossil" meteorites and of significant amounts of nickel from the surface of the earth is therefore an indication that the earth is not particularly old.

The Relationship of Volcanism to Geologic Time

Mention has already been made in an earlier section of this paper of the amount of sulphur emitted from vol-

[9] Nininger, H. H., "Our Stone-Pelted Planet," 1933.

canoes in connection with the small amount of this element in the rocks and in solution in the ocean, which suggests that volcanic activity has not existed in the past over a period of millions of years. This is an important point, for volcanic activity is one of the most striking features of geologic history. Briefly, volcanic eruptions may be compared to the operation of a steam boiler.[10] Water and other gases that are dissolved in the hot rock in the crust of the earth act very much like water in a boiler, and the escape of steam and other gases causes eruptions. Explosive eruptions are comparable to the explosion of a boiler. The amount of water and other gases emitted from volcanoes is enormous. Clarke mentions the measurement of water vapor escaping from one of the numerous parasitic vents on Etna. On this point, Dr. Alfred C. Lane has said:

> "If Foqué was right in estimating that one of Etna's minor parasitic cones emitted in 100 days 2,100,000 cubic meters of water, in 600 years it would discharge a cubic mile of water. Thus only a hundred such vents would suffice to discharge all the 300 million cubic miles of water in the 1,800 million years or so in which it seems likely that we have had plenty of time to have discharged the ocean."[11]

While Foqué's findings are generally accepted as being reasonably accurate, it must be admitted that certain other factors must be considered in any such estimate, such as the possible return (from the uniformitarian viewpoint) of some of this emitted vapor in the form of water to this underground reservoir. Nevertheless, with due allowances, this statement does have startling implications. The output of 100 such parasitic vents of one volcano would obviously be much less than the normal output of all active volcanoes (it is estimated that there are now 420 active or recently active volcanoes) at the present time. Furthermore, if the volcanic action were much greater in the past, as is generally assumed, the production of water by this method would be enormous. It must also be remembered that the oceans are presumed to contain an abundance of water from the beginning. This conclusion is inevitable if it is decided that most of the chlorine was there from the beginning.

A few remarks on the activity of Etna itself as well as the amount of water necessary to have within the earth will serve to show the impossibility of this situation. Assuming that the total output of water of Etna came from ten such parasitic vents, about a cubic mile of water would be produced in 60 years. Etna is known to have been active for a period of about 2500 years, which would mean a total output of 40 cubic miles of water. If this volcano had been active since the time of the Flood, it would have produced about 100 cubic miles of water. But geologists estimate from a study of the size of its cone, at its present rate of increase, that this volcano has been active for 300,000 years, which would mean a total water output of 50,000 cubic miles. But this is quite impossible. What is still more incredible is the belief that volcanism has been going on continuously in Italy (and Iceland) "since Miocene time, which Urry's determinations put over 15 million years ago."[12] If Etna or one other volcano of equivalent activity has been active during this long interval, the total amount of

[10] Clarke, F. W., *loc. cit.*, p. 229.

[11] Lane, Alfred C., *Science*, Vol. 75, April 15, 1932, p. 396.

[12] "Annual Report of the Committee of the National Research Council on the Measurement of Geologic Time," 1936, p. 1.

water produced would be 250,000 cubic miles.

On this basis what would be the combined production of 400 active volcanoes for an interval of 100 million years? Where would this impossible amount of water come from and where would it go?

To look at the other side of the question, what would be the source of all this water, even if all the water in the ocean came from such volcanic activity alone? To supply the water of the ocean from within the earth, there would have to be the equivalent of 8,600 feet deep of water beneath the earth's crust all over the world to begin with, were it all in liquid form. The interior of the earth being hot, however, this would make the crust of the earth like a boiler full of water and heated beyond an explosive temperature. It is incredible, of course, that the earth could have contained so much water. To reach any other conclusion is to ignore the nature of volcanic activity.

Radioactivity as a Measure of the Earth's Age

In view of these evidences of the youth of the earth, the question arises as to how geologists have arrived at such vast estimates of its age. At first, when the science of geology was young, no such vast periods were offered, estimates being based on the rates of erosion and deposits now in progress as compared to evidences of former erosion and deposit. The method is based on the slow but fixed rates at which radioactive elements, especially uranium and thorium, change to certain elements of lower atomic number, i.e., lead and helium. When the amount of uranium and thorium are known in a rock, and also the amount of lead and helium (of the types known to be derived from the former by radioactive disintegration) the proportions of the amounts present form a mathematical basis for estimating the total amount consumed in the process. The time necessary to accomplish this change is made the basis for estimates of the age of the earth.

The theory is simple, but as in the case of age-estimation on the basis of the various elements in the ocean waters, deficiencies in the method have become evident. To begin with, the results from time estimates from the two elements do not agree. Moreover, to the extent that either uranium or thorium entered or left the rock before or after the process began, or to the extent which the lead or the helium left it, after it was thus produced or was there before the process had begun, the calculations will be at fault. And since these factors cannot always be determined, this difficulty seems permanent. Still greater uncertainties are that the age of a given geologic formation by this new method is usually at variance with the supposed age of that formation as it appears in the geologic timetable, so long and laboriously worked out upon the supposed sequence of the evolution of the fossils. The rocks ordinarily dealt with in these estimations are the inorganic rocks, such as granite, and this again bids fair to raise more questions than it settles, because one of the most difficult things in geological science is the decision as to when these granites and other intrusives were first formed, as well as when the intrusion took place.

In the report of the Committee on Geologic Time for 1939-1940, certain important admissions of serious faults in this method are mentioned on pages 62, 63, 73, and 76. In the 1940-1941 report fundamental flaws in the lead residue method were also pointed out. Often it is found that too much lead is present, so that the estimated age is extravagantly great for that specimen, and vice versa. This uranium-derived lead has a different atomic

weight from common lead, which is not so derived, so that the latter must be omitted from the estimate. But even this does not solve the problem; as much of the lead of supposedly uranium derivation is found not to be in fact "radiogenic" (page 55 and elsewhere), thus rendering the calculations worthless.

Looking still deeper into the fundamentals of the problem, the theory is vague as to whether or not these elements originated at the time the rock in which they are now found was formed. If not, then still more uncertainties arise, because it is well-known to mineralogists that many of the ores have been concentrated subsequently to the country rock in which they are now found. It is agreed that such common lead has often been deposited with the uranium and thorium, and if this could occur, naturally the lead of radiogenesis could be so deposited too, making impossible an accurate estimate of what proportions of each type to use in arriving at a final conclusion as to the age of the formation.

It is evident that the radioactive method is the only method that will provide time enough to satisfy present theories of the age of the earth. But if this method were otherwise faultless, the insuperable objections to it would still remain in that (1), the various salts in the ocean water have defied all attempts to work out a consistent estimate of the time required for their accumulation, and (2), all estimates of age are hopelessly too small for the radioactive method. It is evident that they could not possibly have been increased at present rates for more than a small fraction of that length of time, nor could the sulphur have been increased on the surface of the earth at present rates, for so long a time. The ocean salts method, once as popular as a means of estimation of the age of the earth as the radioactive method is now, at present contradicts the conclusions of its late rival, the radioactive method.

For all of these reasons it would seem necessary to reject as unreliable the radioactive method of calculating the age of the earth. The one fact of the constancy of the process of radioactive disintegration seems to be the only fully scientific certainty there is in it. But this is true for all of the radioactive elements, some of which disintegrate very rapidly. The apparently unsolvable problem of judging when and how the radioactive elements were accumulated with reference to the rocks wherein they are now found, is as difficult as the other problems of the chronology and sequence of ore deposition or infiltration, few if any of which are as yet understood. Added to this are the still more uncertain features of the chronology of the plutonic actions by which most of the rocks used in this method came into being or came to their present location. In addition to all this, there remains the tangled relations which this method has with the already supposedly well-established geologic timetable. Lastly, the wide disagreement of the results of this method with those estimated on the basis of each of the elements in the ocean waters, which are far too small in amount if such vast eons of time have elapsed, seems to prohibit further consideration of the radioactive method of calculating the age of the earth.

Summary and Conclusions

One of man's objectives in his search for the history of the past has been to determine the age of the earth. Since the span of years allowed by Biblical chronology is impossibly insufficient to permit of the development of man by the process of evolution designed to replace the story of Creation, it has been necessary first to postulate and then to seek methods to prove an antiquity of the earth consistent with the

philosophy of evolutionary origins. The very essence of evolution must have been that of a slow transition from one type to another. To allow of the necessarily long course of the development of man from the primeval ooze, it has been variously estimated that from a thousand to ten thousand million years have elapsed in the process. If some evidence of the age of the earth could be obtained from some source or sources which would bear out this theory of an incredibly old earth, one would have to admit of the possible truth of the theory of evolution. On the other hand, if estimates made on the basis of various suggested methods fall too far short of these long ages, too short to permit of evolution, it may likewise be concluded that the whole philosophy is false. It has been the object of this study to analyze critically some of the methods which have been proposed for the determination of the age of the earth and the results obtained thereby.

The method used most conclusively up to the past decade or two was a study of the sodium content of ocean water. On the basis of present findings, it has been estimated that the ocean is 100 million years old. This conclusion ignores what seems to be a fair assumption that the ocean must have had some degree of original salinity. Moreover, such an estimate demands a relatively uniform addition of sodium to the ocean, a very unlikely occurrence even from the standpoint of evolutionary geology. This leaching process must have been indefinitely more rapid during the period when the earth had no protective covering of vegetation until well into the Devonian period, roughly four-fifths of presumed geologic time. One can only conclude that under these supposed primeval circumstances, the ocean should long ago have attained its present degree of salinity and the land areas long since impoverished of their sodium content. While objections are raised by evolutionists to the use of other contained elements in the estimation of the age of the ocean, many of these objections are not valid. Such estimates suggest a much shorter history, far too short for evolution to have taken place.

A study of this problem on the basis of rate of depletion of the land of its soluble salts has also been undertaken. It has been estimated that it would require the disintegration of half a mile thick of rock over the face of the globe to provide the sodium now present in the ocean. Since all the land now above sea level spread evenly over the face of the earth would make a layer only 660 feet thick (three-eighths of the required amount) and since the land as yet is by no means depleted of its sodium, it is fair to conclude that the ocean must have had a fair degree of original salinity, and by deduction, must be much younger than the estimate of 100 million years. By figures cited, *all* the sodium above sea level would be removed from the land at the present rate in 32 million years and *all* the chlorine in a million years. But since neither of these elements has been completely removed by a wide margin, even these estimates must be considerably reduced. But they would still disagree with each other in much the same ratio, which renders any conclusion on that basis impossible.

The fallacy of the method of age determination by the rate of deposition of sedimentary rock is obvious when it is realized that there are no uniform stratifications in various localities and the evident fact that thick layers of sediment must have been laid down in a very short time to preserve large animals, often in great numbers, as fossils.

The small amount of helium in the atmosphere also indicates that the

earth cannot be as old as has been presumed by evolutionary geologists.

Evidence from comets and meteors also indicates that the earth is not old. The extremely small amount of nickel in the soil, at the present rate of addition from meteoric dust, also suggests that the process has not been going on for any great length of time.

Volcanism as a source of water furnishes another avenue for investigation of the age of the earth. If the earth were anywhere near as old as alleged, volcanic action alone would have produced an impossibly large amount of water. For example, the water output of Etna in Italy alone would be 250,000 cubic miles in its alleged history of 15 million years.

The most recent and most popular method of estimation of the age of the earth is that of radioactivity. The weaknesses in the method consist in the lack of information as to the relative amounts of lead and helium originally present in the given sample of rock, and the amounts of these elements which may have left or which have entered the rock in the meantime. The results obtained by the method are very often inconsistent with the presumed age of the specimen and with the discredit now being laid at the door of the method, it is likely to be discarded as valueless, even by its most enthusiastic proponents.

As a result of this survey, several facts seem to emerge. In the first place, the results of estimates of the age of the earth as determined by the various methods show too great discrepancies to bring any harmony out of the conflicting conclusions. In the second place, it is evident that the methods are seriously defective in that the original chemical state of affairs in the earth and ocean are unknown, so that one does not know where to begin with the process. Moreover, one cannot be entirely sure that these processes have always proceeded at the same rate as at present. Finally, it is quite certain that, with due consideration of all known factors, the earth has no such a long history as geologists have postulated. In fact, the history of the earth even by these methods is too short to permit of organic evolution having taken place.

Whether from the tangled skein of available evidence, it will be possible to make a more positive approach to the problem, one which can bring some harmony out of the existing confusion, the future alone will tell.

Note: Consult Mr. Whitney's series THE CASE FOR CREATION 4004 B.C. in THE CREATIONIST, Nos. 1, 2, 3, 4 and 5.

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Facts for the Flood

SOME EVIDENCES FOR THE UNIVERSAL FLOOD —AND SOME OF ITS AFTER-EFFECTS

Many modern scholars ridicule and reject the clear biblical teaching of a universal flood in the days of Noah. There is far more evidence favoring a universal flood than there is against it.

Clifford Burdick, writing on Geology and the Flood, says:

> Rogers and Dunbar, in their new text on stratigraphy admit that the principle of uniformity cannot be applied as severely as Lyell would have applied it. For instance they mention petrified trees still standing upright in clay beds of the coal measures. At slow, uniform rates of sedimentation, the trees would have rotted and dropped long before they were covered, but they were covered so swiftly that they showed no decay. They are frank enough to say that this interrupts the uniformitarian picture.
>
> Schuchert, the Yale Stratigrapher, was equally honest when he pointed out that the very fact that fossils are preserved so perfectly indicates that they were buried before predators had time to consume them or otherwise be destroyed by bacteria.
>
> Hugh Miller described some fossil fishes which were buried with gills and fins extended as if in great fright at some overwhelming catastrophe ("Testimony of Rocks.")

Does the Flood Offer an Explanation of the So-Called Ice-Age?

The violence with which the Flood rent and tore the earth has probably never entered into the human mind to conceive. "All the fountains of the great deep"—watery abysses in the caverns of the earth—were "broken up," the earth crust rent to let them through . . . so they almost shattered the granite foundations of the earth. The Lord said, "I, even I, do bring a flood: behold, I will destroy (all flesh) **with the earth,**" (Gen. 6:13, 17). Not only would the uprush of emerging oceans tear and destroy the earth, but the enormous rush of waters, rolling over the earth day and night—all geologists assert that the vast effects on earth-rocks are caused by water—and then subsiding, would create such changes in the earth's crust as one geologist (Prof. Edward Suess) depicts as "of such indescribable and overpowering violence that imagination refuses to follow."

Now the first physical fact it is vital to grasp is an icebound world. We read, "all the high mountains that were under the whole heaven were covered; fifteen cubits upward did the waters prevail" (Gen. 7:19). Even if Mt. Everest (nearly 30,000 feet high) were not pushed to such heights until after the flood, Mt. Ararat is 16,969 feet high—well above the region of freezing cold and far above the snow line—with the result that the globe would be encased in a vast coating of ice, of a thickness impossible to ascertain. The floating bodies of a drowned world would, in a few hours or days, be congealed in ice. Now this is exactly what we find—wrongly interpreted by modern geologists as "the ice ages." "The earlier climate of the earth," says Professor Dana, "abruptly terminated, and the cold became suddenly extreme, as of a single winter's night." The Mammoth, locked in ice, is found, perfectly preserved—with food undigested

in the stomach, and even fresh in the mouth, and in some cases standing erect—frozen so instantly that its very flesh is untainted; and over the whole earth, tropics equally with the arctic, such prehistoric monsters are found in the ice-rind of a submerged world.

Some geologists suggest that some lands, as Scandinavia, "have been moulded, rubbed and polished by one immense sheet of ice, which could hardly have been less than 6,000 or 7,000 feet thick" (Prof. Jas. Geikie, The Great Ice Ages). And Professor Dana estimated the great continental ice-sheet in Connecticut at from 6,000 to 8,000 feet in thickness. Is it possible that the violence of the Flood broke loose huge masses of Arctic ice, a mile or more in thickness, and caused them to float down to temperate zones, to be let down on the earth as the waters assuaged?

"This eternal frost," says Cuvier, "could not have taken possession of the regions which these animals inhabited, except by the same cause which destroyed them, this cause, therefore, must have been as sudden as its effect." So the Lord says, "The waters are hid as with a stone (a cover for a pit, a cistern), and the face of the deep is frozen" (Job 38:30).

But the huge descent of shattering glaciers, together with an inconceivable lateral rush of oceans —"and the waters returned from off the earth" (Gen. 8:3): literally, 'going and returning'; the ebb and flow of a gigantic retreating tide—would plunge and wedge living matter into the very crust of earth, as it excavated its course through rocky beds saturated and softened by water under enormous pressure. Exactly so we find it. In one area covering not less than ten thousand square feet, the rocks contain fish, petrified; contorted in agony; sometimes the tails bent to the head; and in all attitudes of fear, anger and pain. No one fish is injured by the others: none survived: of all living matter the most quickly perishable, yet preserved almost perfect, these fish must have been caught and turned to stone with almost inconceivable rapidity. Entombed in whole shoals, scattered over the globe, hot geysers, or erupting volcanoes, brought the very fish under the judgment of the Flood, and melted earth's foundations. (Professor Bischoff found that the steam of a hot spring at Aix-la-Chapelle, though only from 133 degrees to 167 degrees F., changed blocks of black marble into dough.) Professor Buckland says that the fossil cuttle-fish found in Lyme Regis must have been killed and imbedded in the strata in a moment of time; so rapidly in fact as to be prevented from discharging the contents of their ink-bags. "I must register," he says, "the proofs of instantaneous death, detected in these ink-bags; for they contain the fluid which the living sepia emits in the moment of alarm, and might detail further evidence of their immediate burial, in the retention of the forms of these distended membranes, since they would speedily have decayed, and have spilled their ink, had they been exposed but a few hours to decomposition in the water. The animals must, therefore, have died **suddenly**, and been **quickly** buried in the sediment that forms the strata, in which their petrified ink and ink bags are thus preserved."

Moreover, the enormous subsidence of this cap of ice—ten thousand glaciers in one; not slow-moving, but rocked in huge convulsion, the frightful cataracts of a draining world—sawing and scarring the earth beyond conception, would also bury the vegetable creation. So we find it. In a stone quarry in Craigleith a fossil tree-trunk, slantingly erect, some sixty feet in height, the bark of which had become the purest and finest coal, pierced ten or twelve strata of the white sandstone in which it is embedded. As it could not possibly have been held erect by the strata at its base only, the whole—sandstone and tree together—must have been precipitated by enormous convulsion, that not only overwhelmed the forests, but thus sawed the surface of the earth with wounds deep and swift as lightning. Whole fossil forests are found, erect, rootless, with no base of soil, turned into stone or

coal—one tree will be found, part of it stone, part of it coal—the record of God's judgment act, Sir Chas. Lyell, who himself examined the Craigleith tree, says:—"Stems of a soft and succulent character, and of a most perishable nature, and preserved in flint; and there are instances of the complete silification of the young leaves of a palm tree when just about to shoot forth." So sudden, so destroying earth (Gen. 6:17), yet so preparing the world for new races and a coming incarnation, was this greatest judgment act of God the universe has yet seen.

Finally, a catacylsm so gigantic —a thousand tempests in one; the sway and swing of enormous slipping, slapping oceans—must have turned earth's crust into a vast hecatomb of a judged world. So we find it. The skin of the earth which contains fossil remains of life, is like the rind of an orange, or the skin of an apple, very thin: beneath it is the primitive (or Archaean) rock, the bedrock of the world, in which fossils are never found; and it is this rind of the earth which is the photograph of the Flood. Fossils, animal and human, are found, together, in all the super-Archaean rocks; they are heaped together in numbers so enormous, and in such utter confusion, as is explicable only by a sudden and overwhelming catastrophe; and the bones, like the stones and boulders around them, are rubbed, ground, striated, and smoothed by water.

So Sir Joseph Prestwich, commenting on Italian hecatombs of Hippopotami, animals of all ages down to the foetus, bones showing no trace of weather or exposure, says, "My supposition is that when the island was submerged, the animals in the plain of Palermo naturally retreated, as the waters advanced, deeper into the amphitheatre of hills until they found themselves embayed, as in a seine, with promontories running out to sea on either side and a mural precipice in front. As the area became more and more circumscribed the animals must have thronged together in vast multitudes crushing into the more accessible caves, and swarming over the ground at their entrance, until overtaken by the waters and destroyed."

The world at this moment is a vast graveyard, a gigantic cemetery of capital punishment, because God said, "The end of all flesh is come before me" (Gen. 6:13). (Condensed and adapted from **The Dawn Magazine.**)

— Sword of the Lord

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Fossil PLANTS *Dispute* Evolution

THE dry land seems to have had a small place in the reckonings of the geologists when they constructed their theories of progressive development. The "wash of the waves and the smell of the seashore seemed to penetrate geology; and dry land was seldom thought of by professors or students," fifty years ago. So completely was geological chronology constructed upon the remains of the marine life that now, when more careful attention has been given to the problems, it serves to show how arbitrary modern geology has been in its assumptions as to the arrangement of the fossils in supposed chronological order. It is certain that if the order of the rocks were correctly determined for the animal remains entombed in them, the plant structures also ought to show a reasonable degree of similar succession from the simplest to the most complex.

Ordovician rocks are all of marine origin, and in none of them have plant remains been found. Yet the remarkably "advanced" character of the plant life of the Devonian rocks makes it imperative that a long period of development be allowed for their supposed "evolution." A popular geology text remarks:

"The flora of the Devonian, however, renders it highly probable that land plants were well advanced in the Ordovician, and their remains may be discovered at any time."

This state of affairs is of itself a serious problem for the evolutionary geologist, but there are other problems no less difficult.

In the Silurian rocks we are confronted with the remains of one fern and one land animal, a primitive scorpion. There are no insects, spiders, or even land snails; and one geologist asks the question, "On what could the Silurian scorpions have fed?" The only answer suggested is speculation to the effect that they must have lived on the surf lines catching marine forms which ventured too near the land and were thrown ashore.

In the Devonian rocks we are amazed at the rich and varied assemblage of plants. All the higher spore-bearing plants are represented, and also some kinds of gymnosperms, or cone-bearing plants and trees. Some of the trees show dense wood like that in our modern conifers, and indicate a height of from ninety to a hundred feet. Ferns are common. In many ways the flora of the Devonian rocks compares favorably with that of our own age.

As to the Carboniferous plants, there is almost no distinction between them and those classed as Devonian. Not only are there the same kinds of plants, but the rocks themselves are identical, the sandstones, shales, and limestones so closely resembling those of Devonian strata that Dana says that it is only by the evidence of the fossils that anyone could tell any difference. When the plants are alike and the rocks are alike in which they are found, there is at least a strong suggestion that something must be wrong with the scheme of classification that would make two great divisions of geological time out of what appears to be a homogeneous assemblage of plants and rock specimens.

by HAROLD W. CLARK

The Carboniferous forests are pictured to us as immense dismal swamps, with no higher flowering plants, but simply vast stretches of ferns, horsetails, and similar plants. Such areas of marshy ground may have existed as ecological units, as they do today. But to assume that no other kind of life was in existence elsewhere at the same time is assuming something that is exceedingly difficult to prove. Yet it is upon such an assumption that the whole scheme of evolutionary geology is built. So sure of this point was William Bateson, the famous English biologist, that when he was asked for proof that there were no higher animals in these early geological periods, he pointed to the lack of any angiosperms as his strongest evidence. Notice what he says about it:

"Happily, however, there is one example of which we can be sure. There were no angiosperms—in the carboniferous epoch—the angiosperms are cosmopolitan. By their means of dispersal they must have immediately become so. Their remains are very readily preserved. . . . Hence we may be sure that they did appear on the earth since those times." —William Bateson, *Science*, Jan. 20, 1922.

The certainty of this proof received a hard blow when Dr. A. C. Noe, of the University of Chicago, reported an angiosperm in a true Carboniferous bed in Illinois. In the light of this discovery, Dr. Noe was forced to the conclusion that the "lines of descent which seemed to converge in the Mesozoic take an aspect of greater parallelism which presupposes an immensely removed focus, just as the sunbeams appear parallel to the eye and yet we know of the convergence." —A. C. Noe, *Journal of Geology*, May-June, 1923.

Coming to the Cretaceous rocks, we find enormous deposits of angiosperms which do not in any way appear to be primitive. The only hope of the evolutionist lies in finding further evidence, which at present is sadly lacking. One writer has said, "Sometime a series of fossil forms may be discovered showing this character in its formative stage."

Many of the Cretaceous beds are found in Greenland at a latitude of 69-79 degrees north. In one such bed were found one hundred seventy-five plants identical with forms growing in Europe, North America, and Asia. Among them were ferns, walnuts, magnolias, pines, oaks, breadfruit, figs, cinnamon, and scores of temperate and semitropical trees. How these large, complicated types could have "arisen" suddenly is puzzling, to say the least. In one case that has been reported from Greenland, three hundred species of plants are found which are now common in the United States. They are the dominant fossils in many of these northern deposits. Their abundance, and their similarity with modern forms makes it hard to believe that plant evolution has been a long, slow process. One prominent writer says of this situation:

"The radical change in plant forms which occurred without previous transitional links in the Cretaceous period when the angiosperms, plants with seeds enclosed in an ovary, suddenly appeared as the dominant type of flora, is one of the impossible questions to explain by evolution."—L. T. More, *The Dogma of Evolution*, page 157.

A leading authority on fossil botany discusses the problem at quite some length. The following quotation is to the point:

"In geological history the angiosperms first appear in the Lower Cretaceous, and by the Upper Cretaceous times had already swamped all other vegetation and seized the dominant position which they still hold. Thus they are isolated structurally from the rest of the vegetable kingdom, while historically they suddenly appear, almost in full force, and apparently without intermediaries with

other groups. To quote Darwin's vigorous words: 'The rapid development, as far as we can judge, of all the higher plants within recent geological times is an abominable mystery.' "

"The evolution of plants, so far as record shows, does not present a uniform progression, but rather a series of diverse periods of vegetation, each with a character of its own."—D. H. Scott, *Darwin and Modern Science,* page 205.

"Not only do angiosperms suddenly become dominant in all known plant-bearing deposits of Upper Cretaceous age, but strangely enough the earliest found seem to belong to living orders, and commonly have been referred to existing genera."—*Encyclopedia Britannica,* 11th ed., art. "Paleobotany."

With these facts before us, what conclusions may we draw as to the interpretation of fossil plants? The supposed order of the geological deposits offers no clew as to the evolution of the plants. Those which are found in the so-called "lower" formations are of such a complex nature that they demand long ages of previous development; but in the rocks assigned to those previous ages, no traces of plant life can be found. The Devonian and Carboniferous remains are practically identical as far as the great families are concerned, the chief difference being in the species assigned to the different ages. The Carboniferous and Cretaceous, while varying somewhat in characteristics, have nothing in them that would tell a story of ages of development, if we leave out the a priori opinion that assigns the different species to different ages.

Remarkable and interesting conclusions are being reached by some of the leading authorities in this field of study. In 1916 Dr. Lotsy, a Dutch botanist, disgustedly wrote that phylogeny is not a science, but a product of fantastic speculation. In 1924 D. H. Scott said that, like Dr. Lotsy, he had become skeptical of most evolutionary classifications. How then, are they going to interpret the facts, if not by the theory of gradual and progressive development? We find several leading writers expressing the idea that we must consider two sharply contrasted periods, the first one when the great families arose, the second when these great groups broke up into many other divisions, corresponding to our present genera and species.

This is what the creationist has been contending for all the time! The fact that there are definite species of plants and animals which occupy fairly restricted ranges today, and that one range may be replaced by another as we go across the country, points to a time when conditions have been much different than they are today. As different types spread over the earth, some would become adapted to new conditions that others could not so well endure. We find, for example, a series of oaks, much alike, yet varying in many ways, and distributed from one end of the continent to the other. With these, as with many other kinds of animals and plants, almost identical species can be found occupying contiguous areas in the country.

If we take the suggestion of the first period referred to, and think of it as the original creation, then consider the second period as the time following creation, we have an interpretation in terms of creationism rather than in terms of evolution. It would seem that we could almost see the dawn of a new day in science if men of science could only break away from the evolutionary obsession that blinds their eyes to the possibility of any other viewpoint. The "conflicting" evidence that makes so much trouble in the ranks of the evolutionists fits perfectly into the creationist scheme of things.

SIGNS of the TIMES
for AUGUST 10, 1943

FOSSILS, FLOOD AND FIRE
by Prof. H. W. Clark, $5.95

Shall We Teach Science or Speculation?

By Leander S. Keyser

A WRITER in the New York *Times* contends that to bar the teaching of evolution from our tax- supported schools would practically mean the elimination of the teaching of all science from public instruction. Among the sciences which he thinks would have to go are the following: Paleontology, geology, astophysics, general physics, physical chemistry, astronomy, physiology and hygiene.

That, we hold, is poor reasoning. It indicates a lack of ability to make clear distinctions, especially the distinction between science and speculation. Of course, the books which are soaked through and through with evolution, mixing up real scientific data with unwarranted speculation, would all have to be re-written.

And they ought to be. No man has a moral or a scientific right to pronounce an *ex-cathedra* judgment in favor of evolution. If, therefore, an author has based his whole scheme on the theory of evolution, it has a wrong foundation under it, and will come tumbling to the ground when all the facts are brought in and analyzed with critical acumen. Many tomes ought to be reconstructed entirely, with the vain speculations and far-fetched inferences elided, and only the scientifically demonstrated facts left to stand. Then we would have real science.

We hold that science can be taught without the underpinning of evolution. Take biology. Before us, as we write, lies Prof. George A. Baitsell's "Manual of Biological Forms" (The Macmillan Company, 1923). In the whole work there occur only one or two slight hints of evolution. Yet it is a most informing book. It tells us precisely what we want to know about the functioning of living organisms—about the cell, its chemical composition, its nucleus, chromosomes and genes, its wonderful power of mitotic division; about organization, reproduction, etc.; and yet not a word of speculation is indulged in regarding spontaneous generation, the transformation of species, or the descent of man from a bestial stock.

The great advantage of this kind of treatment for the student is this: he learns just what scientists have found out about life and its marvelous processes, and yet his

mind is not confused with a lot of wild speculations about problems that physical science has not solved and perhaps can never solve.

For a moment let us draw the line of demarcation between science and speculation by means of some concrete cases. Science knows much, as above indicated, about the unit of life, namely, the cell, its form, its structure, its bisecting power. So far science. But when the scientist begins to talk about the origin of the primordial cell or cells millions of years ago, either by creation or evolution—that is speculation.

Again, science can tell us much about the process of reproduction by pollenization in plants and by fertilization among animals, so that each species is able to reproduce its own kind. That is science. But when the scientist tries to make believe that all the millions of species evolved from one original cell, moneron or proteron through millions of eons—that is speculation.

The scientist can tell us much about human life; the anatomy of the body; the physiology of its structures; how the various kinds of cells perform their offices, etc., etc.; about the many differences and homologies between man's physical structure and that of animals and vegetables. That is science. But as soon as he tries to establish a genetic relationship between *genus homo* and the simian tribes, an evolution requiring untold millenniums, he is leaving the domain of science and plunging into the fogland of speculation.

Cannot everybody see where science ends and speculation begins? Now, in the name of science itself (not of religion just now), the scientists ought to refrain from vain theorizing and stick to the facts. Will somebody say why? Because sensible people want the established facts of science, not the mere fancies of the scientists. As it is, more time seems to be spent in some colleges and university class rooms trying to cram down the throats of students the speculative theory of evolution than to set forth the plain empirical data of science. And that is the main crux in the uprising against that highly speculative theory. Yes, it is in the interest of science itself that anti-evolutionists are calling for text-books of true science, with all useless speculations left out.

If the teacher believes in evolution, he does not need to teach it dogmatically, for if he does not know enough of science to know that evolution has not been placed on a scientific basis, he is hardly fit to teach science. On the

other hand, if he believes in direct divine creation, he does not need to promulgate that doctrine either, in tax-supported schools, because that is not the place to teach religion. The public schools are supported by all our citizens, whether they are religious or not. Everybody ought to remember that. Is not that a fair proposition? Is it not also one hundred per cent American?

There are two kindly suggestions we would like to make to the scientists: (1) Stick to the facts; (2) be humble enough to say you do not know—when you do not.

In contrast with the excellent work by Professor Baitsell, mentioned above, we place Dr. J. Arthur Thomson's work, "The Biology of Birds." This is also an instructive work. Just as long as the author sticks to the facts, he conveys real information about bird life, and his writing is full of interest. But the trouble is, he is obsessed with evolution. His whole book is saturated and dripping with it. So, apparently without realizing it, he is constantly passing from the realm of scientifically established facts, and skipping and skimming over into the realm of fancy and speculation. And he asserts his speculations with just as much positiveness as he does his facts. He spends much time, for example, in trying to prove that the avian families evolved from the reptiles some time in the remote ages gone—many millions of years ago. He argues that in some mysterious way the scales of the reptiles evolved into the feathers and wings of the birds! Thus the student is constantly sent off into the land of imagination, and thus wastes precious time; while he might be learning more of what is actually known. And the serious matter is that, led by so renowned a scientist, the student may himself become confused as to which are facts and which are only fancies. It is all too sadly true to-day, that many noted scientists have mastered their logic so poorly that they do not seem to discern the line of demarcation between the established data of science and their own flights of speculative imagination.

We are persuaded of two things. One of them is that there is no science which cannot be taught well and thoroughly without lugging in the theory of evolution. The other is that the cause of true science would be advanced rather than retarded by being freed from this stranglehold of evolution. Much precious time is spent to-day in trying to prove the unproveable, namely, evolution, which would better be spent in discovering real facts and making a practical application to them of the needs of life.

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